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Modelling nova populations in galaxies

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Abstract

© 2016 The Authors.Theoretical modelling of the evolution of classical and recurrent novae plays an important role in studies of binary evolution, nucleosynthesis and accretion physics. However, from a theoretical perspective the observed statistical properties of novae remain poorly understood. In this paper, we have produced model populations of novae using a hybrid binary population synthesis approach for differing star formation histories (SFHs): a starburst case (elliptical-like galaxies), a constant star formation rate case (spiral-like galaxies) and a composite case (in line with the inferred SFH for M31). We found that the nova rate at 10 Gyr in an elliptical-like galaxy is ~10-20 times smaller than a spiral-like galaxy with the same mass. The majority of novae in elliptical-like galaxies at the present epoch are characterized by low-mass white dwarfs (WDs), long decay times, relatively faint absolute magnitudes and long recurrence periods. In contrast, the majority of novae in spiral-like galaxies at 10 Gyr have massive WDs, short decay times, are relatively bright and have short recurrence periods. The mass-loss time distribution for novae in our M31-like galaxy is in agreement with observational data for Andromeda. However, it is possible that we underestimate the number of bright novae in our model. This may arise in part due to the present uncertainties in the appropriate bolometric correction for novae.

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Keywords

Binaries: Close, Galaxies: Individual: M31, Novae, cataclysmic variables, White dwarfs